



Marietta Public Meeting June 24, 2010

Health Study of Manganese (Mn) Exposure of Marietta OH and Mt. Vernon OH Adults: Preliminary Results



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In July of 2009, San Francisco State University received a federal grant from the U.S. Environmental Protection Agency (U.S. EPA) to conduct a health study of adults exposed to environmental manganese in Marietta, Ohio. As a part of the health study, Mount Vernon, Ohio was selected as the comparison city because it is nearly identical demographically, but without the industrial activity and manganese emissions.

Summary:

In general, blood, neurological assessments, and neuropsychological test results of Marietta and Mt. Vernon residents did not differ significantly. The overall test results for both communities are within the average range of the general population.

History and background:

Eramet Marietta, Inc (EMI) is located near Marietta and is a major producer of manganese ferroalloys. Historically, EMI ranks first in total air release of manganese and manganese compounds among U.S. facilities. In 2000, U.S. Senator Mike DeWine (OH) petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate air pollution-related health effects in residents of Marietta, Ohio.

After a multi-year ATSDR investigation, a July 2009 Health Consultation concluded that manganese was the only chemical which exceeded both background levels and health-based guidelines. ATSDR noted that a data gap existed in the scientific literature regarding the effect of long-term, low-level manganese exposures on the general population. ATSDR supported the announcement of a U.S. EPA-funded health study of adult exposure to manganese in the Marietta community, as it would provide important information about the potential effect of manganese exposures in this community.



Study purpose, objectives and methods:

Workplace studies of occupations such as mining and welding show that excessive airborne manganese inhalation exposure can result in negative nervous system health effects. The main purpose of the health study was to evaluate whether such changes are detectable in a community with long-term, residential airborne manganese exposure.

Approximately 100 adults in each community between the ages of 30-75 years were randomly selected. The data collected from both communities include a general health questionnaire, blood test, neurological assessments, neuropsychological tests, and sensory and mood assessments. Blood was analyzed for levels of manganese (Mn), cadmium (Cd), lead (Pb) and mercury (Hg). Blood samples were also analyzed for levels of serum ferritin (Ferr-S) – an indicator of iron stored in the body. A battery of assessment tools was used to measure cognitive flexibility, information processing, working memory and attention, memory, visual tracking speed, verbal skills, motor dexterity and strength, and tremors.

In addition to blood tests, two estimates of environmental manganese exposures looked at modeled air manganese concentrations for each participant. The first estimate, the “hazard” quotient (HQ), is a ratio between modeled household manganese levels and the U.S. EPA reference value for manganese. The second measure of past manganese exposure was calculated using modeled household manganese levels multiplied by the number of years of residency. This was called the cumulative exposure index (CEI).

Study Results

General Health: There was no difference between the amounts of manganese in the diets of the two communities. There were no differences between participants of the two communities in the percent of people reporting poor or fair health, the average number of poor physical or mental health days in a month, the percent of adult smokers, the prevalence of adult obesity, or the prevalence of types of chronic illnesses.

Some health symptoms were more frequently reported by Marietta participants. Those included: changes in sensory function, headaches, tightness of facial muscles, feeling anxious and irritable, and changes in personality.

Blood: The average levels of manganese in blood of the general population range between 4 -15 µg/L. The average level of blood manganese of Marietta residents was 9.65 µg/L. The average level of blood manganese of Mt. Vernon residents was 9.48 µg/L. There was no significant difference between the blood manganese levels in the two communities. Similarly, no differences were seen between both communities for blood cadmium, lead and mercury.

Neurological assessment &

neuropsychological test: Scores in both communities were within expected ranges. No significant differences between the communities were found for test of motor speed, motor strength and tremor, attention and immediate memory, switching categories and divided attention, visual delayed memory, and verbal delayed memory. One neurological test assessing slowing of movement showed slightly lower performance in Marietta residents. Higher HQ and CEI were associated with worse scores on some of the cognitive tests.

Mood tests: No significant differences were found between the communities on mood disturbance, except for higher levels of phobic (fear) anxiety among Marietta participants. The CEI was associated with mood disturbances but overall, levels of blood manganese were not.

Conclusion:

Overall results do not demonstrate negative health effects from airborne and blood manganese in Marietta residents. However, residences within 2.5 miles of Eramet were found to be exposed to higher levels of modeled manganese. Those residing closer to the plant scored worse on several of the neuropsychological tests. Few differences between the two cities were noted, and in general, both cities were within normal ranges for the overall neurological and neuropsychological tests.

What's Next?

As mentioned in the document title, these findings are preliminary. Ongoing data analysis may revise the conclusions slightly and may result in additional research.

Thank you:

We offer our sincere gratitude to all who helped develop and participated in this study. Participants will receive a personal letter and copy of their test results. Both of your communities and this effort will be recognized and you can be proud of your contributions to this community-based study and overall public health knowledge of manganese.

For more information:

You can learn more about the study results after June 24th at: <http://online.sfsu.edu/~mnstudy/>



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